AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

The following listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims

1. (original) A method of detecting misfire in an engine comprising:

detecting engine speed fluctuations;

determining a linear model for estimating engine firing events based on the engine speed fluctuations;

applying a Kalman filter to the linear model to determine parameters of the linear model; and

detecting a misfire event in the engine based on the linear model.

2. (original) The method of claim 1 further comprising representing the linear model as a difference equation.

3. (original) The method of claim 2 further wherein applying the Kalman filter includes estimating parameters of the difference equation.

4. (original) The method of claim 1 further comprising reformulating the linear model using standard state space systems equations.

5. (original) The method of claim 1 further comprising determining a load compensator signal based on an engine speed and a manifold absolute pressure, wherein detecting the misfire event includes detecting the misfire event based on the firing event signal and the load compensator signal.

6. (original) A method of detecting misfire in an engine comprising:

detecting crankshaft speed fluctuations in the engine;

determining a linear model for estimating engine firing events based on the crankshaft speed fluctuations;

representing the linear model as a difference equation;

estimating parameters of the difference equation at a Kalman filter to determine a firing event model; and

detecting a misfire event in the engine based on the firing event model.

7. (previously presented) A misfire detection system that detects misfire in an engine comprising:

a sensor that determines speed fluctuations of the engine;

a controller that determines a firing event model for estimating engine firing events based on the speed fluctuations of the engine and applies a Kalman filter to the model to estimate parameters of the model,`; and

a misfire detector that detects a misfire event based on the model.

8. (original) A misfire detection system according to claim 7 wherein the firing event model is a difference equation.

9. (original) A misfire detection system according to claim 8 wherein the Kalman filter estimates parameters of the difference equation.

10. (original) The method of claim 7 wherein the controller determines a load compensator signal based on an engine speed and a manifold absolute pressure, and wherein the misfire detector detects the misfire event based on the firing event model and the load compensator signal.

11. (withdrawn) A method of detecting misfire in an engine comprising:

drawing a nonlinear, dynamic model of a firing system for the engine using engine speed, manifold absolute pressure and a firing event signal;

simplifying the nonlinear, dynamic model by separating it into an engine firing event estimator function and an engine load compensator function;

expressing the engine firing event estimator function as a difference equation having a plurality of unknown model parameters and a measurement noise factor;

utilizing a system identification technique to estimate values for the model parameters;

determining a firing event signal using the firing event estimator; and

detecting a misfire event using the firing event signal.

12. (withdrawn) The method of claim 11 wherein the system identification technique comprises a Kalman filter.

13. (withdrawn) The method of claim 11 wherein the engine load compensation function comprises a function of engine speed and manifold absolute pressure.

14. (withdrawn) The method of claim 13 wherein the engine load compensation function is implemented as a look-up table.

15. (withdrawn) the method of claim 13 wherein the engine load compensator function is implemented as a surface map.

16. (withdrawn) The method of Claim 11 wherein the difference equation is of the form

$$y(k) = b_o N(k) + b_1 N(k-1) + \ldots + b_m N(k-m) + v(k)$$

where $b_o \ldots b_m$ are the model parameters and N is the engine speed at sample k, $k-1$, $\ldots k-m$, where k and m are integers.

17. (new) The method of claim 3 wherein the linear model is an inverse linear model of a linear model of engine crankshaft speed.

18. (new) The method of Claim 17 wherein the difference equation is of the form

$$y(k) = b_o N(k) + b_1 N(k-1) + \ldots + b_m N(k-m) + v(k)$$

where $b_o \ldots b_m$ are the model parameters and N is the engine speed at sample k, $k-1$, $\ldots k-m$, where k and m are integers, and applying the Kalman filter to estimate parameters of the difference equation includes applying the Kalman filter to estimate the model parameters.